REMARKS

Applicant has amended the claims to more particularly define the invention taking into consideration the outstanding Official Action. Claim 5 has been amended to remove the term "closed" rejected in the Official Action and replace it with "recycling" as it is clear that the process is a recycling process. This amendment is fully supported by the specification.

In addition, claims 7 and 16 have been amended to remove "high temperature" in view of the objection to the term "high" as unclear in its meaning. Claim 9 has been further amended as supported by the specification to provide additional steps essential to the process. Claim 18 has been added to a specific aspect of the invention as set forth in the paragraph bridging pages 2 and 3 of Applicant's specification. Applicant most respectfully submits that all the claims now present in the application, claims 5-9 and 16 are in full compliance with 35 U.S.C. 112 and are clearly patentable over the references of record.

The rejection of claims 5, 8 and 9 under 35 U.S.C. 102 as anticipated by or, in the alternative under 35 U.S.C. 103 as obvious over Voet et al. has each been carefully considered but is most respectfully traversed in view of the amendments to the claims and the following comments.

With respect to the anticipation rejection, Applicant wishes to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

> "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of

terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

In the Official Action it is urged that Voet teaches on page 136 decomposition of methane to deposit carbon on particulate carbon. It is recognized that there is no mention of forming hydrogen, however this is deemed to occur since the hydrogen is not otherwise accounted for. The carbon substrate is micropulvarized to a size of 1800Å which is deemed to be indistinguishable from dust. This rejection has been carefully considered but is most respectfully traversed.

Applicant most respectfully submits that it is not believed that the Examiner has properly appreciated the claimed invention. The invention resides in pyrolysing an organic gas by passing it through the heated reaction chamber and recycling it so that the gas passes through the chamber many times. Recycling is a claim limitation which cannot be ignored and clearly distinguishes the claim invention over the teachings of the Voet et al. reference. Accordingly, it is most respectfully requested that the anticipation rejection over Voet et al. be withdrawn.

Applicant most respectfully submits that the claimed invention is not obvious to one of ordinary skill in the art in view of Voet et al. As just noted the presently claimed invention resides in pyrolysing an organic gas by passing it through the heated reaction chamber and recycling it so that the gas passes through the chamber many times. This allows the catalytic carbon dust particles to grow significantly to a size where they can be mechanically trapped and therefore retrieved from the reaction. It also means that a hydrogen-rich stream may be extracted from the input organic gas. Furthermore, the efficient pyrolysis and hydrogen/carbon production achievable in accordance with the invention means that the reaction chamber does not need to be heated to 1000°C or more but may be operated as low as 300 or 400°C (see claim 18) which brings the operating range into the realm of waste heat from other processes rather than requiring specialized heating.

The Voet et al. article makes no suggestion whatsoever of recycling the gases nor of the desire efficiently to produce large amounts of hydrogen and carbon. Indeed,

this would not appear to be achievable in accordance with the Voet teaching, and, in any event, it does not have the advantage that the process may be run at significantly lower temperatures than 1000°C and therefore utilize waste heat form other ordinary processes. None of this is mentioned or suggested by Voet et al. which relates to the determination of pore sizes and pore size distribution of carbon blacks by the t curve procedure wherein it is said that exposure of carbon blacks to methane at 1050degrees C must lead to pore filling but there is no suggestion of the presently claimed process, including precipitation and recycling of the carbon black particles in accordance with the present invention. The invention as claimed is therefore considered to be both novel and unobvious over Voet et al and it is most respectfully requested that these rejections be withdrawn.

The rejection of claims 5-9 and 16 under 35 U.S.C. 103 as being unpatentable over DD 118263 A1 (hereinafter the '263 reference) has been carefully considered but is most respectfully traversed for the reasons set forth in the discussion of this reference on pages two and three of Applicant's specification and the following comments.

Applicant wishes to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a

claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

In the Official Action it is urged the reference teaches in Example 1 heating carbon particles by heat exchange from another process then depositing carbon on them from the decomposition of a hydrocarbon. The product can be milled and recycled. The Official Action acknowledges that the reference does not teach powder. However, using a powder therein is said to be an obvious expedient to provide a carbon source on which deposition can occur and which is fine enough to have a sufficient residence time for the reaction but does not provide any reason in support of this position which clearly relies upon impermissible hindsight. In re Fritch, 23 USPQ 1780, 1784(Fed Cir. 1992) ("It is impermissible to engage in hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps.).

Applicant wishes to note that Applicant's comments with respect to Voet et al as noted above, apply to the '263 reference. This reference discloses a pyrolysis process in which carbon particles are heated to a temperature in excess of 1000°C before being injected into a hydrocarbon gas within a relative large reaction chamber. The transit time of the carbon particles through the reaction chamber is very short in such an arrangement and there is, therefore, little opportunity for the carbon particles to grow in size. Furthermore, the relatively low rate of pyrolysis means that no hydrogen-rich gas stream is produced.

By contrast, the present invention involves heating the reaction chamber in which the carbon dust resides and further recites a recycling loop rather than the in-line arrangement taught in the '263 reference. In accordance with the invention, both carbon and hydrogen may be produced from the hydrocarbon fuel thus extending the range of possible uses and commercial potential of the system. The invention allows a much higher rate of pyrolysis as the amount of active carbon per unit volume may be orders

of magnitude higher. Accordingly, it is most respectfully requested that this rejection be withdrawn.

Applicant notes that the present application is the national stage of a PCT application and that the Notification of Acceptance of Application Under 35 U.S.C. 371 indicates that the priority documents have been received. Accordingly, it would be appreciated if in the next Official Action, the claim for priority and receipt of the priority documents could be acknowledged to complete the record in this regard.

In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,

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